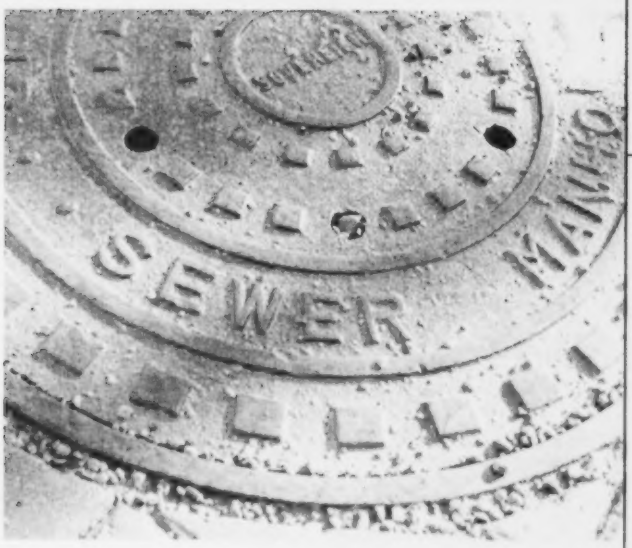


Drop by Drop

Urban Water Conservation Practices in Western Canada

Robert Roach, Senior Policy Analyst
Vien Huynh, Policy Analyst
Sarah Dobson, Intern

Western Cities Project Report #29

February 2004

CanadaWest FOUNDATION

WESTERN CITIES PROJECT

This report is part of the Canada West Foundation's ***Western Cities Project,*** a multi-year research and public consultation initiative focused on identifying the policy challenges faced by western Canada's largest cities, and best practices in resolving such policy challenges. Through the Canada West Foundation's emphasis on citizen engagement, the Western Cities Project promotes public awareness of the growing importance of cities to the economic, social and cultural lives of western Canadians.

The project began in 2000 and includes the following research components:

- Urban Water Management • Urban Infrastructure • Urban Finance • Urban Regions • Urban Aboriginal People
- Urban Growth and Affordable Housing • Marketing Western Cities on the Global Stage
- Municipalities in Federalism • Urban Arts and Culture

To learn more about the Western Cities Project, please visit the Canada West Foundation website (www.cwf.ca).

This report was prepared by Robert Roach, Vien Huynh, and Sarah Dobson, and is part of the Canada West Foundation's *Urban Water Management Initiative*. The opinions expressed in this document are the authors' only and are not necessarily held in full or in part by the Canada West Foundation's donors, subscribers, advisors, or Board. The authors and the Canada West Foundation express their appreciation to everyone who agreed to be interviewed for this report.

The Canada West Foundation recognizes and thanks the funders of this report: The Walter and Duncan Gordon Foundation, an anonymous philanthropic foundation, and the Cities of Calgary, Edmonton, Regina, Saskatoon, and Winnipeg. Additional funding for the larger Western Cities Project was provided by the Federation of Canadian Municipalities (FCM), the Alberta Urban Municipalities Association (AUMA), and the City of Red Deer.

The authors would like to thank the Urban Water Management Initiative Advisory Committee for their ongoing advice and suggestions: Mark Bennett (Bow River Basin Council), Allen Bleich (Winnipeg Water Watch), David Calam (City of Regina), Allan Davies (Epcor Water Services), Dianne Draper (University of Calgary), David Elton (Max Bell Foundation), Haque Emdad (Natural Resources Institute, University of Manitoba), Vern Hart (City of Calgary), Bill Hewitt (City of Saskatoon), John Hodgson (City of Edmonton), Eric Knudtson (City of Calgary), Susan Lamb (Meewasin Valley Authority, Partners FOR the Saskatchewan River Basin), John Lilley (Canadian Water Resources Association), Barry MacBride (City of Winnipeg), Harold Taylor (Red River Basin Commission), and Sharon Willianen (North Saskatchewan Watershed Alliance). The views expressed in this document are not necessarily held in full or in part by advisory committee members or the organizations they represent.

Permission to use or reproduce this report is granted for personal or classroom use without fee and without formal request. Copies may not be made or distributed for profit or commercial advantage. Additional copies are available from the Canada West Foundation, or may be downloaded from the CWF website [www.cwf.ca].

Walter & Duncan Gordon
FOUNDATION

© 2004 Canada West Foundation
ISBN 1-894825-29-2

Executive Summary

Encouraging water conservation is an overarching goal of the Canada West Foundation's *Urban Water Management Initiative*. Our water is too important to our quality of life to take for granted; it must be treated as a valuable and irreplaceable resource in need of careful and forward-looking stewardship. Water policy – be it at the federal, provincial, or municipal level or developed by businesses and nonprofit organizations – must take a holistic view of the water system including where our water originates, where it ends up, and the water cycle's productivity over the long-term. This holistic approach requires all areas of policy that affect water – from land use to industrial regulation – to work together in an integrated fashion to protect watersheds and water quality.

Although it takes a broad perspective in terms of its concern for the overall health of the water system – from source to tap and back again – the Canada West Foundation's *Urban Water Management Initiative* seeks to increase the understanding of, and the attention paid to, *urban* water issues. This focus reflects the fact that eight out of 10 westerners live in urban areas and that municipal governments are key players in the delivery and treatment of water and, in turn, are critical pieces of the conservation puzzle.

The benefits of water conservation include preservation of the environment in general and watersheds in particular, management of future risk associated with natural and manmade environmental changes, cost savings including reduced municipal infrastructure spending, improved water quality, and more effective water crisis management.

Drop by Drop examines municipal water conservation policy in six large western Canadian cities (Vancouver, Calgary, Edmonton, Regina, Saskatoon, and Winnipeg) and identifies a number of barriers to effective urban water conservation policy: water conservation policy threatens the revenues generated by the sale of municipal water services; because water is generally seen as an abundant resource, there is resistance to fee increases and a general lack of interest in conservation; and political leadership is lacking and water conservation is not a policy priority.

To overcome these barriers and to improve municipal water conservation policy, the report recommends that:

(1) Municipal governments should adopt and commit resources to large-scale, long-term water conservation strategies rather than rely on a limited set of tools.

(2) Municipal governments should finance water utilities in ways that do not undermine the goals of water conservation.

(3) Municipal governments should commit significant levels of human resources to water conservation.

(4) Municipal governments that draw water from a common watershed should work together to develop region-wide conservation strategies.

(5) Governments should seek to create linkages across policy areas, integrate policies that affect watersheds, and encourage water conservation in all areas of government activity.

(6) Governments should partner with other organizations to educate the public about water conservation.

(7) Governments should facilitate the use of new water conservation technology.

(8) Provincial governments should use urban water conservation as a foundation for encouraging industrial and agricultural conservation.

"Water is to Canadians as the Alps are to the Swiss - something that transcends the resource - it is part of how Canadians see themselves. We are a land of lakes and rivers. Our history is built on water."

- Don Gamble, Scientist

I. Introduction

Water - like air, food, and shelter - is necessary for life. Without it we die. Tragically, a lack of clean water is a problem faced by billions of people worldwide and is a major cause of serious health problems and premature death. Fortunately, water contamination tragedies such as those in Walkerton, Ontario and North Battleford, Saskatchewan are the exception in Canada.

Indeed, when it comes to water, Canadians are extremely fortunate for two reasons: we have lots of it (although not always when and where we need it); and we have sufficient financial resources and technology to clean, distribute, and protect it. As a result, Canadians have access to abundant, high quality water for domestic, agricultural, industrial, and recreational use. This does not mean we are immune to water shortages, but, relatively speaking, we are a water-rich country.

At the same time, Canadians are extremely heavy users of water. We use a lot of water to keep our lawns green, flush away our sewage, irrigate our farms, hydrate our livestock, extract natural resources, manufacture products, and generate power. Our wealth also means that the footprint we leave on the environment that produces our water is deep and wide. You do not have to go far to see a new subdivision of a city destroying a wetland, a dam altering the flow of a river, or pollution reducing the quality of a lake or stream.

Moreover, a number of factors are putting pressure on our water system. These include population growth, economic development, and the mounting complexity of the policy environment as multiple governments must manage relationships among a broad range of stakeholders.

Although we are starting from an enviable position, if we take our water supply and water system for granted - and many of us do - we risk placing our health, economic prosperity, and overall quality of life in jeopardy. The water supply and the water distribution and treatment system (including wastewater) need both short-term and long-term management. Taking them for granted will lead to adverse consequences for the environment and for ourselves.

Fortunately, there are many people in government, the nonprofit sector, business, and among the general public who are very concerned about our water. Yet, as demands on the water supply and water system increase and as new issues emerge, there is more work to be done. In particular, increasing awareness *outside the water sector* of the importance of water and increasing understanding of what needs to be done to ensure a long-term supply of high quality water are pivotal steps toward changing our water use habits.

In order to help raise the profile of water issues and to encourage informed debate about them, the Canada West Foundation

104-06899/

launched the *Urban Water Management Initiative* in 2003. As the name indicates, our work is focused on *urban* water issues. Although only one piece of a complex puzzle, the urban dimension is especially important given that eight in 10 western Canadians live in urban areas.

Residents of Canadian cities use a lot of water – an average of 343 litres per day!* Getting urbanites to think about the water they use is also important because it involves a direct connection to the water cycle and the water distribution and treatment system. We turn on the tap and flush the toilet everyday, and therefore each of us can do something about our individual water use habits. This, in turn, sets the tone for the broader debate about the future of our water and the value of conservation by all types of users.

There is broad agreement in water policy circles that water conservation is a laudable goal. Water conservation helps maintain the productivity of watersheds, protect fragile ecosystems, control water and wastewater treatment costs, reduce pressure on aging infrastructure and the need for new infrastructure, increase the number of users accessing a finite water source, sustain downstream flows, and maintain supply during dry periods. The ability to influence the demand for water is, therefore, an important weapon in a municipal government's policy arsenal. However, policies designed to reduce the amount of water used by urbanites do not receive the attention they deserve. It is, therefore, worthwhile to examine the water conservation tools available to, and in use by, municipal governments.

Drop by Drop does this by presenting an overview of urban water conservation practices in six of the West's big cities (Vancouver, Calgary, Edmonton, Regina, Saskatoon, and Winnipeg). Relevant literature on municipal water conservation tools was reviewed and preliminary lists of water conservation practices in each of the six cities under consideration were developed using publicly available information such as government websites and reports. The preliminary lists were then sent to the six cities for verification.

In addition, *Drop by Drop* examines the key advantages of and barriers to water conservation as reported by a survey of urban water conservation experts. Twenty-one telephone interviews with key informants from the government sector, research community, and water conservation groups were conducted in November and December 2003. The following questions were used to gather information:

1. Why is water conservation important?
2. To what extent are water conservation tools working or not working?
3. What are the barriers to the implementation of water conservation tools?

The responses to these questions allowed for the identification of common themes regarding urban water conservation policy and how to successfully implement it.

Overall, *Drop by Drop* is designed to inform and encourage debate about water conservation in western Canada's large urban areas.

* This figure refers to the average Canadian served by a municipal water system in 1999. When all uses of water are considered (e.g., agricultural, industrial, power production, and municipal), the figure jumps to a whopping 4,490 litres of water per Canadian per day (Brandes 12).

II. The Value of Water Conservation

Using large western Canadian cities as case studies, *Drop by Drop* looks at the *demand* side of urban water use rather than the *supply* side. From a supply side perspective, there are two main concerns: 1) finding ways to maintain or increase an urban area's supply of water through increased withdrawals, more storage, or new infrastructure; and 2) ensuring the quality and safety of water. Demand side approaches, on the other hand, involve reducing the amount of water used by individual consumers. From the demand side perspective, conservation, not more water, is the answer to meeting an urban area's water needs. For example, the supply side response to a growing urban population may be to increase the amount of water withdrawn from the local watershed whereas the demand side response may be to introduce water meters and charge water rates based on the amount of water used as a means of encouraging conservation. The water saved through conservation would be used to meet the needs of additional consumers without having to increase supply or at least not having to increase it as much.

Curbing use through demand management is important for several reasons:

Environmental Preservation

Water is produced by the fragile and interconnected ecosystems that comprise our environment. The more water we use – even if we return most of it to the system – the more damage we do to the environment (e.g., the disruption of natural habitats and the introduction of contaminants). Water is part of a complex system that includes the air, the land, and living things, and the less we disturb it, the better off both it and we are. Doing something as simple as installing a low-flow toilet or repairing a leaky faucet may reduce the footprint we leave on the ecosystems that produce our water. Reducing the amount of water we use is only one factor in watershed stewardship; water conservation must be integrated with, for example, land use policy and environmental protection policy in general.

Managing Future Environmental Risk

Uncertainty about the effects of large scale environmental changes – both natural and manmade – such as long-term weather cycles, global warming, erosion, and population growth on the water supply adds to the case in favour of conservation. Learning to use less water now will help sustain the sources of our water and prepare us for instances of water scarcity.

Financial Benefits

Water demand management is an environmentally-friendly and efficient alternative to costly investments in supply infrastructure (e.g., constructing dams or diverting water). If urban residents and urban businesses use less water, the absolute cost of withdrawing water, cleaning and testing it, delivering it to users, re-treating used water before it is returned to the watershed, and the often forgotten future expenses related to the maintenance of the watershed itself, will fall. This will save municipal governments and, by extension, taxpayers money in the short-term by reducing annual expenditures and in the long-term by reducing pressure on an urban area's infrastructure. These savings could be passed on to taxpayers or used to help ensure the future viability of the water supply by investing in the protection of upstream watersheds and better treatment of drinking and wastewater.

On the other hand, municipalities raise a significant amount of annual revenue from the sale of water and wastewater services. It is often not clear, however, that these revenues cover the full cost of providing the water when capital expenditures, the long-term maintenance of the watershed, and other costs are included. In cases where users are actually paying the full cost of the water they use, conservation will save individual users money that can be spent on other things. Whether government is subsidizing water use or water users are footing the entire bill, one way or the other, reducing the amount of water used will save money.

Water Quality

Protecting the ecosystems that produce our water is one way to ensure the *quality* as well as the *quantity* of our water. Natural aquifers and the ecosystems that sustain them are key to the overall quality of the water supply as are policies that keep the introduction of contaminants from industrial (e.g., from a pulp and paper plant) and individual (e.g., phosphates from car washing or pouring paint down the drain) pollution to a minimum. As noted above, conservation reduces the pressure on the natural water system and the environment in which it is embedded. A second way to ensure quality is through the direct intervention of municipal water treatment. Arguably, the less water and wastewater a municipality has to treat, the better able it will be to conduct and monitor the treatment process and reduce the urban footprint left on the downstream water system.

Crisis Management

If something goes wrong with the water supply (e.g., a breakdown at a treatment plant) or the availability of water is limited due to dry conditions (e.g., during hot summer weather), conservation and the demand management tools that encourage it can be helpful in two ways. First, ongoing conservation helps keep down the amount of water a city needs to produce each day and, by so doing, lessens the stress placed on the system by a crisis or a prolonged shortage. Second, the use of demand management tools that are already in place for general conservation can be increased to see a community through shortages and crises.

III. Water Conservation Tools

Proponents of water conservation stress that sustainable choices in the present are needed to maintain the integrity of the water supply and the ecosystem that supports it in the long-term. To achieve this goal, communities have adopted a variety of water conservation tools (also known as water demand management tools). Through economic incentives, technological changes, and behavioural modifications, water conservation tools attempt to conserve water by reducing the amount of water used, minimizing the waste of water, and increasing the recycling of water (Dziegielewski). Key goals of water conservation include more efficient water use and the reduction of both the human impact on the environment and the degradation of the water supply.

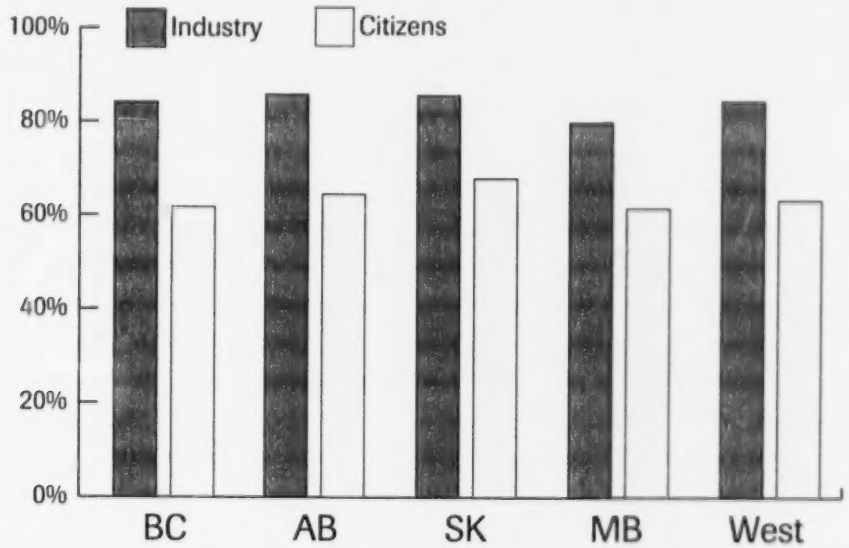
A tool highly advocated as an effective method of reducing water consumption is the use of metering. Metering has been an important tool in showing consumers how much water they consume, and is a first step in establishing an effective pricing system (Tate).

The economic component of water conservation operates on the assumption that environmentally responsible behaviour can be induced through economic incentives and disincentives (Howarth). Charging a price for water that reflects its true value would provide consumers with an incentive to use water more efficiently and reduce waste. In a survey conducted as part of the University of Victoria POLIS Project on Ecological Governance,* results show that lower water usage roughly corresponded with individual metering and volume based pricing. In the twenty cities surveyed, the lowest per capita water users were cities that employed metering and a volume based pricing structure (Brandes). However, without an appropriate pricing structure, increasing the price may merely result in a considerable amount of the conservation burden being placed on lower-income households, whose water bills compose a relatively higher percentage of their income compared to wealthier households (Renwick and Archibald). This equity problem can be overcome by devising block-pricing schemes in which basic needs are provided at a lower cost (Sauri). A barrier to using pricing as a tool is the perception of water as a human entitlement, rather than as a commodity that should be priced according to its value (Howarth).

To what extent do the six western cities under investigation use water metering and rate structures to encourage water conservation? As Table 1 demonstrates, the use of residential water meters and rate structures varies across the cities.

A recent Canada West Foundation survey of western Canadians found that six out of 10 respondents agree that governments should charge the full cost of water to citizens and that eight out of 10 agree that industrial users should pay the full cost of the water they use (see Figure 1). These findings suggest that there is a basis upon which to build support among the public for an

Figure 1: Percentage of Respondents That Agree/Strongly Agree That Governments Should Charge the Full Cost of Water to Industry, Citizens



Source: Canada West Foundation Looking West Survey 2003

* More information on the POLIS Project on Ecological Governance is available at www.waterdsm.org.

Table 1: Water and Wastewater Rate Structures by City

Vancouver

- Not metered for residential, although it is being considered
- Flat rate for residential
- Constant block rate structure for multi-residential, commercial, and industrial

Calgary

- Partially metered
- Flat rate for residential – minimum monthly rate plus aggregate monthly rate, charging per thousand square feet
- Constant block rate structure for metered residential
- Declining block rate structure for multi-residential
- Higher constant block rate structure for irrigation use
- Wastewater charges based on percentage of water used (differs by customer class)

Edmonton

- Fully metered
- Inclining block rate for residential
- Declining block rate structure for multi-residential and commercial
- Performance-based rates: EPCOR (the city-owned water utility) can increase rates annually for the next 5 years at 0.5% less than inflation. At the same time, certain performance standards must be met. If these standards are not met, EPCOR is penalized by being required to pay refunds to its customers
- Seasonal wastewater pricing: residential customers are not charged for water that does not enter the sewer system (outdoor water use in summer). Wastewater charges from April to September are capped to the average amount of water used from October to March (winter), plus an additional five cubic metres (effective July 1, 2003)

Regina

- Fully metered (replacement of all meters installed before 1992)
- Constant block rate structure
- Wastewater charges based on percentage of water use (differs by customer class)
- Eliminated minimum water consumption charge

Saskatoon

- Fully metered
- Declining block rate structure sewer charge for residential
- Constant block rate structure sewer charge for commercial
- Wastewater charge based on metered water rate
- Minimum water and sewer monthly charge

Winnipeg

- Fully metered
- Declining block rate structure
- Fixed quarterly charge
- Wastewater charge based on the metered volume of water

Flat rate – charge for water is fixed regardless of the amount that is used (43% of Canadian households)
Declining block rate – charge per unit of water decreases as consumption increases (12% of Canadian households)
Constant block rate structure – charge for water increases uniformly as consumption rises (36% of Canadian households)
Inclining block rate – charge per unit of water increases as consumption increases (9% of Canadian households)
Seasonal rates – unit price of water increases during a peak seasonal use period
Combination flat/block structure – Constant rate up until a certain level of water consumption, after which each successive unit of water is charged at a declining, constant or increasing block rate

end to subsidized water prices. However, it is less clear how this support would be affected if the full cost of water is found to be much higher than expected by respondents.

Significantly increasing the price charged for water is not likely to be a popular option and will, in turn, meet with stiff political resistance. This points to the value of combining economic incentives with other measures such as public education programs and water use restrictions. In this regard, there is an array of tools at hand to coerce or encourage users to conserve water (see Appendix 1 for a detailed list of tools). The inventory of water conservation tools in use in Vancouver, Calgary, Edmonton, Regina, Saskatoon, and Winnipeg (summarized in Table 2 and outlined in detail in Appendix 2) illustrates the range of options for encouraging conservation that is available to municipal governments and highlights the checkerboard nature of water conservation policy across jurisdictions. Each city approaches water conservation in its own way. This suggests that municipalities have much to learn from one another regarding what works and what does not work in this critical area of public policy.

Despite the variation, most cities use a combination of metering and volume-based rates (Vancouver is an exception but it is currently considering these options), public education and information, and water use restrictions. It is important to note that the cities may also be involved in funding groups that support water conservation initiatives, but that this form of support is not included in the inventory.

IV. KEY BENEFITS AND BARRIERS

> "Water supply management is a one-time solution focused on large-scale, centralized infrastructure to buy a community time until the next issue, whereas demand management relies on smaller-scale, more diffuse solutions that can be implemented over time."
>
> *– Tony Maas, POLIS Project on Ecological Governance*

Interviews with key informants revealed two main benefits to water conservation in addition to its critical importance to the continued productivity of watersheds:

Reduced Infrastructure Spending

If the demand for water stays at its current level, municipalities will be faced with significant expenditures for expanding and replacing existing water system infrastructure. Water conservation is a "least cost tool" that can eliminate, delay or reduce the magnitude of costly new infrastructure projects. Reducing the volume of water that flows through the distribution and system can also result in lower maintenance costs.

For example, in 1990, the City of Regina's five-year projections showed that expansion of their water treatment plant would be necessary if demand trends did not change. In response, the City expanded an existing program of water conservation that had been implemented in 1985. Thirteen years later, expansions to the water supply system and sewage treatment plant have not been necessary. Similarly, water conservation efforts in Edmonton have enabled the City to defer expansion costs of $150 million.

Table 2: Municipal Water Conservation Tools

	Vancouver	Calgary	Edmonton	Regina	Saskatoon	Winnipeg
Residential Meters	• Not metered	• Partial	• Universal	• Universal	• Universal	• Universal
Subsidies and Incentives	• Rain barrel program • Roof leader disconnection program • Retrofit program	• Water managed sites • Indoor/outdoor water savings kits • Toilet replacement rebate program	• Rain barrel program	--	--	--
Fines and Disincentives	• Air conditioner regulation • Water rationing bylaw • Repair of leaks • Improper use of water	• Water restrictions • General water service interference	--	--	--	• Waste water prohibition
Public Education and Information	• Public awareness program • A to Z of H2O • Conservation tips • Conservation landscaping • Conservation demo garden • Irrigation workshops • Water efficiency films • Xeriscape information • Water efficiency initiatives	• Team Water Wise • Lawn and garden care information • Online water conservation tips • Water efficiency school program • Community school program • Radio advertisements • Summer water conservation campaign • Waterways newsletter	• Odd-even watering program • Water efficiency in lawns/gardens • Online home water audit • Public awareness	• Communication of water conservation program • Xeriscape programs • Voluntary water restrictions • Tips for water conservation • Plant tours for schools	• Public appeals	• Residential retrofit • Slow the Flow program • Estimation of water bills • Outdoor water conservation • New technologies in water conservation • Manitoba advanced housing demonstration project
Other	• Water audits • Composting toilets • Water conservation analyst • Fee for establishing water service • Ultra low flow fittings	• Water use study • Water main replacement program • System leak detection program • Crestmont pilot project • Water efficient fixtures bylaw	• Water reuse at the Gold Bar wastewater treatment plant • Water efficiency coordinator • Network maintenance program • Water restriction measures	• Water conservation program • Water meter replacement • Water main replacement • Reduction of unaccounted water • Automated irrigation system • Water loss reduction coordinator	• Water loss audit	• Water conservation database • Excess water use analysis • Water main repairs • City water efficiency initiatives • Water conservation team • Water service connection fee

Reduces the Constraint to City Growth

A reality faced by rapidly growing municipalities is the constraint to growth created by a finite or dwindling water supply. Calgary, for example, is located in a very dry part of Alberta and has a limited supply of water. Reducing demand provides a means to overcome this barrier to growth by increasing the potential number of users without having to increase supply.

However, despite these benefits, the respondents noted a number of barriers to the implementation of demand management policies by municipal governments:

Revenue Tradeoffs

Despite broad agreement that reducing demand is beneficial for a variety of reasons, a negative side-effect of water conservation from the perspective of water utilities and city councils is less revenue generated by the sale of municipal water services. Water conservation can reduce operating costs, but other unavoidable maintenance costs associated with upgrading systems are still borne by water utilities. In addition, the savings that result from reduced demand over the long-term (e.g., reduced capital expenditures and the cost of repairing damaged watersheds) – the very savings that make conservation a cost-effective policy – tend to be pushed aside by short-term funding priorities or discounted because, as is the case with repairing damaged watersheds, they are not a municipal responsibility. The key is to see water conservation as a long-term cost containment strategy and eliminate the tension created within water utilities between encouraging conservation and the threat to revenues (and what the revenues make possible – e.g., higher treatment standards) that conservation represents. Cities may have to cover short-term revenue losses caused by falling demand in order to achieve the long-term benefits of conservation. Another option is to have a separate charge (i.e., a tax) for water system infrastructure costs that is not linked to volume. In general, water conservation should be given priority over revenue generation on the grounds that its benefits (e.g., watershed protection, increased downstream supply and quality, deferred capital expenditures) outweigh the money lost due to decreased sales.

Public Perceptions About Supply and the Price Charged for Water

The most significant barrier to water conservation is the commonly held (but mistaken) belief that water is an infinite resource (this belief is often referred to as the myth of overabundance). Given this apparent abundance of supply, it is argued that water should be inexpensive. Hence, there is significant resistance to using fee increases as a water conservation tool. In particular, individuals in municipalities that have not been acutely affected by water shortages do not see the justification for fee increases, but instead see them as tax grabs. Water conservation efforts must, therefore, overcome the belief on the part of most users that there is lots of water (so why conserve?) and the reluctance on the part of city councils to use fee hikes as an incentive to curb use.

In addition, there are valid concerns regarding the effects of fee increases on low-income households and outstanding questions regarding the practical effectiveness of fee increases. Getting users and elected officials to understand and appreciate the true cost of water including the less visible current and future costs of maintaining the natural water system itself is a major challenge.

Lack of a Policy Environment Conducive to Water Conservation

How do policymakers create and implement water conservation policies in a politically contentious environment? Meters and fee increases, in particular, are policies that have been shown to be effective but unpopular measures. It is argued that to have an effect on demand, fee increases have to be significant. Elected officials, however, have their hands tied as they try to strike a balance between keeping water reduction a priority and keeping the voters happy. Elected officials need to show more leadership on this issue. However, it is not merely an issue of someone making the decision at the top; water conservation has to have broad support in the community. Engaging the public and encouraging individuals to recognize their roles as stakeholders in water conservation will allow them to take ownership of the policy and generate real change.

It is important to note that the conservation burden does not lie solely with municipalities. Provincial governments and the federal government have key roles to play in creating and maintaining a policy environment that is friendly to water conservation. It is also critical government departments other than those directly responsible for water policy (e.g., health, infrastructure, education, agriculture, industry, natural resources, etc.) work together and adopt a conservation ethic. Indeed, every possible policy lever should be engaged. Governments should develop, coordinate, and stick to long-term water conservation plans.

Resistance to Metering

Water meters are an important conservation tool because they show consumers the amount of water that they are using and demonstrate that water consumption is something under their control. Meters can reduce water consumption by 70-80 litres a day. Installing meters and moving from flat rate to volume based pricing is suspected by non-metered users as an effort by the water utilities to boost revenues.

To help address these barriers and to reap the benefits of water conservation, the respondents recommended the following policy options:

Promoting a Conservation Ethic

Oliver Brandes from the University of Victoria POLIS Project on Ecological Governance commented on the Canadian perception of water:

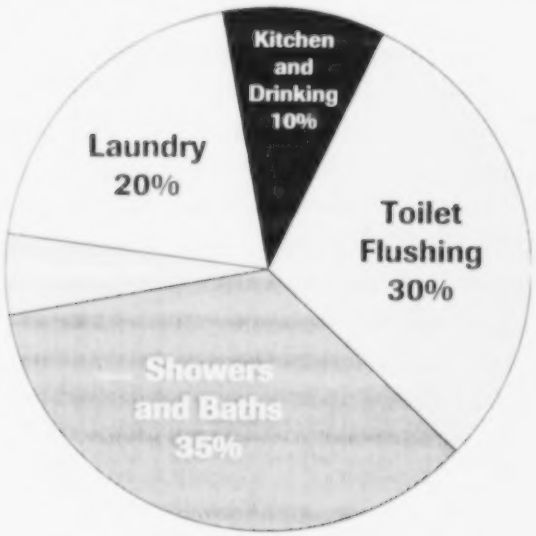
> Historically, we viewed water resources as unlimited – it was just a matter of how much we could harness. Now we're entering a period, both in Canada and internationally, where the intensity of water use has increased (and continues to increase), so real environmental limits are being reached. Water limitations coupled with current use patterns will impact urbanization, where water is a critical component. Many urban centres are now dealing with water shortages and potentially a limited water future due to rising pollution levels, increasing consumption associated with population growth and expanding urban centres, and shrinking supplies.

This era is marked by uncertainty and the threat of climate change. The past century was a wet century; the next century may

be much drier. These changes demand a shift in our attitudes toward water use. This shift in attitude and the changes in individual behaviour that should accompany it are pivotal to the success of water conservation policies. Educating people about the need for water conservation and how to do it can help accomplish this, but only if the message is carried out in an appropriate manner. One-shot education initiatives are ineffective; consumers need to be hit with the message several times.

An effective education program should connect individuals back to the ecosystem. This is particularly important for urban water users who may be disconnected from the broader environment and unaware of their impact on it. In addition to having a positive effect on water reduction, developing a conservation ethic may have beneficial spillover effects, such as influencing people to reduce their use of fossil fuels and recycle.

Figure 2: Water Use in the Home, Canada, 1999



Source: Environment Canada

Water Efficient Technology

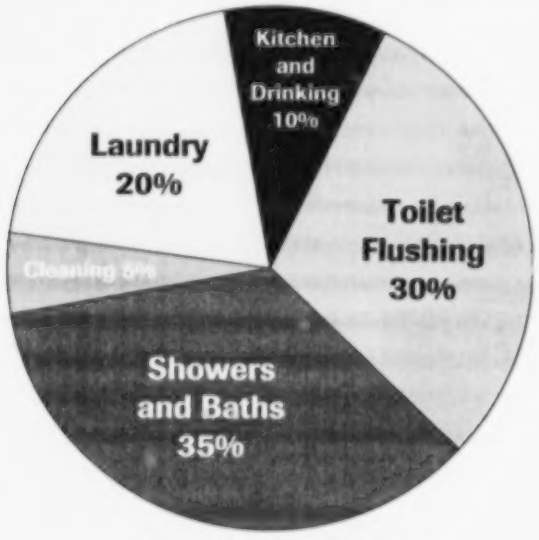
Across the board, respondents agreed the adoption of water efficient technology is pivotal in reducing urban water demand over the long-term. With 65% of water use in the home allocated to toilet flushing and showers (see Figure 2), reducing demand through low flow technology has great potential.

For apartment buildings, low flow technology is a necessary measure to reduce water demand given that it is often logistically very difficult for each apartment to be metered. Bylaws that require new housing developments to install low flow devices and rebates for existing homeowners to replace their old technology are effective ways to help ensure widespread adoption.

be much drier. These changes demand a shift in our attitudes toward water use. This shift in attitude and the changes in individual behaviour that should accompany it are pivotal to the success of water conservation policies. Educating people about the need for water conservation and how to do it can help accomplish this, but only if the message is carried out in an appropriate manner. One-shot education initiatives are ineffective; consumers need to be hit with the message several times.

An effective education program should connect individuals back to the ecosystem. This is particularly important for urban water users who may be disconnected from the broader environment and unaware of their impact on it. In addition to having a positive effect on water reduction, developing a conservation ethic may have beneficial spillover effects, such as influencing people to reduce their use of fossil fuels and recycle.

Figure 2: Water Use in the Home, Canada, 1999



Source: Environment Canada

Water Efficient Technology

Across the board, respondents agreed the adoption of water efficient technology is pivotal in reducing urban water demand over the long-term. With 65% of water use in the home allocated to toilet flushing and showers (see Figure 2), reducing demand through low flow technology has great potential.

For apartment buildings, low flow technology is a necessary measure to reduce water demand given that it is often logistically very difficult for each apartment to be metered. Bylaws that require new housing developments to install low flow devices and rebates for existing homeowners to replace their old technology are effective ways to help ensure widespread adoption.

Water Reuse

Currently, treated drinking water is being used for purposes that do not require this level of treatment (e.g., watering lawns and flushing toilets) and is often only used for one purpose and then sent down a drain to the sewer system. Instead of using treated drinking water for watering lawns and flushing toilets, options are available for reusing wastewater to meet these needs and, by so doing, increasing the productivity of the water that flows through our homes.

Given that only a small percentage of domestic water use is for internal consumption (see Figure 1), there is great conservation potential in reuse practices. Despite this, there are significant barriers to adopting water reuse. First, water reuse requires significant investment in changes (physical and regulatory) to the water distribution and disposal systems that are currently in use. Another significant barrier facing water reuse is the lack of trust in and familiarity with the concept on the part of consumers. It will take some time to successfully manage the philosophical shift for recycled water to become an acceptable alternative to treated drinking water for non-drinking uses.

Regional Cooperation

Partnerships among municipalities are a potential vehicle for encouraging water conservation throughout a region. Most water management is based on municipal boundaries and does not take into account the natural regions created by watersheds. This can lead to conflict and reduce the effectiveness of water conservation tools.

Human Capital

Having the appropriate personnel in place within municipal government structures is an important factor affecting water conservation policy implementation. Water conservation specialists embedded in the municipal policy process are instrumental in ensuring that water conservation tools are implemented in an integrated fashion and on a long-term basis.

Together, these themes point to the barrier to water conservation created by the tendency to take the water supply for granted and, in turn, of the importance of changing public attitudes and perceptions. If these change, public and political support for water conservation will increase and facilitate a more sustainable approach to meeting the water needs of urban users. It took tragedies like North Battleford and Walkerton to move the debate about ensuring water quality forward. We should not wait for similar crises before we improve our policies regarding water conservation in Canada.

Key informants interviewed by the Canada West Foundation agree that water conservation is a critical policy goal and that water conservation tools can be effective. They stressed the value of conservation to the long-term health of watersheds and its ability to save cities and their residents money. Conservation is also seen as a necessary means of meeting the water needs of growing cities in dry parts of the region and of avoiding massive new infrastructure expenditures.

New technology, the reuse of water, metering, and price increases were all identified as effective water conservation tools. It was stressed, however, that these tools must be deployed as part of long-term and broadly-based water conservation strategy rather than as individual measures. Just as a conservation ethic needs to be developed among the public, a similar ethic needs to take

root within government bureaucracies and among elected officials. This ethic, moreover, needs to spread across government departments rather than remain contained in water departments because water use is affected by a broad range of policies (e.g., land use). Making sure the human resources are in place to research, develop, implement and assess water conservation policies and practices was also seen as critical, as was the need for communities to work together on water conservation given that watersheds do not respect political boundaries.

Identifying and articulating the financial benefits of water conservation is critical but so too is the breaking of the link between increasing the volume of water sold and the ability of water utilities to finance their operations and improve water safety. As long as supporting conservation creates revenue problems for water utilities, significant barriers to water conservation will remain embedded within municipal governments.

Overall, there was a strong sense among the key informants that water conservation policy can work and that governments and individual citizens can make a major difference in this area and enhance our economic prosperity and quality of life over the long-term.

V. Recommendations

Based on analysis of relevant literature, the inventory of current water conservation practices in large western cities, the key informant interviews, and ongoing conversations with a range of stakeholders, the following recommendations for improving urban water conservation policy emerge:

(1) Municipal governments should adopt and commit resources to large-scale, long-term water conservation strategies rather than rely on a limited set of tools.

For water conservation policy to have a measurable impact on water use, a broad array of demand management tools must be aggressively deployed. One measure or a series of stop gap measures are not enough to alter ingrained attitudes and habits. For example, imposing water restrictions during peak water demand periods may curtail water use in the short-run, but the effects are temporary and may not change individual behaviour over the long-term. Water conservation tools should be long-term in nature, as the effects of water conservation policy are not always immediate.

(2) Municipal governments should finance water utilities in ways that do not undermine the goals of water conservation.

When water utilities are forced to choose between encouraging conservation and maintaining revenues based on the volume of water sold, tension is created. This tension works against water conservation. Governments should examine ways to finance their water utilities that do not undermine the goals of water conservation. This includes recognizing the long-term cost savings that may be realized through conservation, breaking the link between water system funding and the volume of water sold, ensuring that water fees cover the full-cost of maintaining and improving the system, and never using revenues generated by the sale of water services to finance other government programs.

(3) Municipal governments should commit significant levels of human resources to water conservation.
Water conservation policies do not implement themselves. Creating and fostering the intellectual capital to promote water conservation within the government will be beneficial in the long-term.

(4) Municipal governments that draw water from a common watershed should work together to develop region-wide conservation strategies.
Regional cooperation of this sort avoids the problems created by some municipalities attempting to conserve water while others connected to the same watershed are not. Regional cooperation also helps spread the word about the value of conservation and enables municipalities to share resources and lessons about best practices.

(5) Governments should seek to create linkages across policy areas, integrate policies that affect watersheds, and encourage water conservation in all areas of government activity.
The water system and water conservation are affected by policies in other areas such as land use, natural resources, energy, and agriculture. Hence, there is a need to integrate water conservation policy with other relevant policy areas.

(6) Governments should partner with other organizations to educate the public about water conservation.
Education is one of the best tools to change behaviour. Programs targeted to youth go a long way in shaping perceptions – developing a water conservation ethic at a young age is instrumental in encouraging lifelong conservation. In addition, the age group of 13-19 years is the highest user of water relative to other age groups. Education is pivotal in helping people understand why they should use water meters, use low flow fixtures, and reduce their outdoor water use. Political will is needed to put in a framework that will allow, or promote, the adoption of conservation on a widespread scale. Education can create a political environment where water conservation is considered a priority, rather than a politically unpopular policy. While raising the price of water and implementing water meters are seen as negatives by consumers, education may assist consumers to understand the importance of these measures.

(7) Governments should facilitate the use of new water conservation technology.
Low flow fixtures, for example, have been shown to have a significant effect in reducing water demand over the long-term. Reusing wastewater also has a lot of potential. However, infrastructure must, where appropriate and feasible, be adapted to incorporate these changes. Currently, it would cost billions of dollars to retrofit buildings to include wastewater reuse technology. Changes in the way these structures are made are necessary to accommodate future changes. New residential developments can also be designed to accommodate retrofitting, giving homeowners the option to eventually adopt wastewater reuse.

(8) Provincial governments should use urban water conservation as a foundation for encouraging industrial and agricultural conservation.
Effective urban water conservation policy can be used as a model for reducing overall water use. Lessons learned in the area of urban water demand management should be applied to industrial and agricultural water conservation and support for urban water conservation should be used as a signal for changes in other areas.

VI. Conclusion

When it comes to water conservation, every drop counts. This is true in terms of the physical impact on the overall water system and in terms of changing our collective attitude and approach to water use. If urban users are wasteful, it makes it that much more difficult to make a case for broader conservation efforts. In addition, water conservation tools that can be used by individuals or directed at them are instrumental in creating awareness of water issues and inculcating an ethic of conservation. It is this shift in attitude that will help drive a shift in policy and in the results of that policy. One of the main barriers to collective action is the sense on the part of citizens that they are powerless to enact change – that their actions do not make a difference. Urban water conservation tools provide citizens with real actions to take and show them that they can indeed make a difference.

Works Cited

Brandes, Oliver M. with Keith Ferguson. 2003. *Flushing the Future? Examining Urban Water Use in Canada.* Victoria: University of Victoria POLIS Project on Ecological Governance.

Dziegielewski, Ben. 1999. "Management of Water Demand: Unresolved Issues." *Water Resources Update* 114. Carbondale, IL: Universities Council on Water Resources.

Howarth, David. 1999. "Privatisation - A Help or a Hindrance in Managing Water Demand?" *Water Resources Update* 114. Carbondale, IL: Universities Council on Water Resources.

Renwick, Mary O. and Sandra Archibald. 1998. "Demand Side Management Policies for Residential Water Usage: Who Bears the Conservation Burden?" *Land Economics* 74(3).

Sauri, David. 2003. "Lights and Shadows of Urban Water Demand Management: The Case of the Metropolitan Region of Barcelona." *European Planning Studies* 11(3).

Tate, Donald M. 1990. *Water Demand Management in Canada: A State of the Art Review.* Social Science Research Series 23. Ottawa: Environment Canada Inland Waters Directorate Water Planning and Management Branch.

APPENDIX 1: Common Urban Water Conservation Practices

There is an array of tools at hand to coerce or encourage water conservation. The following list of water conservation tools illustrates the range of options available to municipal governments:

1. Meters

Water meters track the volume of water used by residential, institutional, and commercial customers and are typically used in combination with volume-based rates that charge customers based on the amount of water they use. Water meters encourage conservation by creating a link between the amount of water used and the price paid for water. In theory, users will use less water to save money.

2. Wastewater recycling

Return of reclaimed wastewater to be used again for the purposes that generated the wastewater. For example, treatment and recycling of all household wastewater for toilet flushing and other non-potable uses. A key component of water recycling systems is matching water quality and use.

3. Wastewater reuse

Use of reclaimed wastewater for a purpose other than that for which it was initially used. For example, the implementation of grey water reuse technology that reuses water from washing for other household uses such as toilet flushing and outdoor watering. Wastewater reuse is currently not widespread in Canada due to regulatory barriers.

4. Flow control devices

Reduce the amount of water that flows through a water distributing fixture. Common flow control devices are low flow aerators for faucets and low flow shower heads.

5. Distribution system pressure reduction

Reducing water pressure decreases the amount of water that flows through the water mains from a distribution centre. Reductions in water pressure may not be feasible in some established areas where previously implemented systems for activities such as fire fighting and customer irrigation may be negatively affected. In new areas, especially those where topography permits, pressure reduction is a more feasible option, however it is necessary to ensure that decreases in water pressure do not create a potential health hazard that can occur if pressure is reduced to the point where contaminants are drawn into the system through leaking water main joints or cross connections.

6. Water-saving devices

- Low/Dual-flush toilets
- Toilet tank displacement devices
- Low-flow showers
- Faucet aerators
- Front loading washing machines
- Water-efficient dishwashers
- Swimming pool covers

Adapting, replacing or originally installing water-efficient devices or appliances. These generally cost more originally, but will save the user both water and money in the long-run. The most successful in saving money are usually dishwashers and washing machines since they use less heated water which results in savings in both water and energy.

7. Drought resistant landscaping/xeriscaping

- Reduced turf area
- Improved soil structure (increased water retention)
- Mulching garden beds

Low-maintenance/water efficient landscaping that requires little more water than what is provided by nature. Principles of a low-maintenance landscape are a reduced amount of lawn; proper selection of native grasses, shrubs and trees; use of rain barrels and roof drainage for watering; mulching to reduce evaporative losses around shrubs and trees; improvements to soils; a proper irrigation system; and planned maintenance.

8. Efficient sprinkling/irrigation technology

- Irrigation/Hose timers
- Drip systems
- Watering during non-peak times of the day
- Use of water gauges
- Electronic water sensors
- Trigger operated hose nozzles

Use of watering devices for lawns and gardens that minimize the amount of water lost to evaporation, over watering, and unnecessary watering on sidewalks and driveways. Sprinkler efficiency can be improved by using a sprinkler that is fitted to the size and shape of lawn, that lays water down in a flat pattern, and that is used in conjunction with a timer. The most efficient irrigation technology is the drip irrigation system which applies water only to the roots of plants.

9. New process technologies

Alternatives to conventional wastewater treatment centres such as off the grid sanitary sewage systems that use waterless composting toilets.

10. Rainwater cistern systems

Systems that collect rainwater, which is then used as an alternative source to central water systems that provide potable water. Cistern systems can be either advanced or basic. The advanced systems collect and store large quantities of water, which, depending on the filtration and treatment services, can be used as both a potable and non-potable water source. The most basic system consists of barrels or ponds that gather rainwater without treatment, which is then used primarily for irrigation (garden/lawn watering).

11. Land use planning

Land use policy can be used to determine the density and location of new housing developments, and can in turn be used to control the capital, operating and maintenance costs of water and wastewater infrastructure. As the density of housing and lot size increases, water consumption per household will decrease, due mainly to a drop in outdoor water use.

12. Water efficiency standards

Regulations that require all water using products sold in the market to meet certain efficiency standards (levels of water use). Water efficiency standards may be difficult to implement because there are not always standard tests for measuring the water efficiency of products, and setting minimum standards may exclude some products from the market that have higher water consumption but are preferred by consumers for other attributes (e.g., top loading washing machines).

13. Leak detection and repair

- Sonic detection devices
- Tracer dyes
- Improved inspection and maintenance
- Leak detection tablets (toilets)

There are two main types of leakage found in the water supply chain. The first is in the actual supply lines. Water lost through these leakages is unaccounted for, and as a result, never paid for. The second leakage is found within the pipes/appliances of water consumers. For a metered customer that pays on a block structure, this water is accounted for and paid for through the meter, but never used. For an unmetered customer, this water is both unaccounted for and never paid for. Up to 30% of total water entering supply lines can be lost due to leaking pipes. If unaccounted for water is anywhere above 10%, it is generally cost effective to implement a leak detection and repair program.

14. Water use restrictions

Restrictions on water use activities that may result in wasted water such as watering in the middle of the day, allowing water to run off an area being watered, hosing hard services, or allowing water to be lost through leaks. More specific/stringent restrictions are generally put into place when a municipality experiences a water shortage. These may include prohibiting the use of water for all activities not related to health or safety.

15. Restrictions on delivery

Placing limits on the volume of water delivered to customers during peak periods of demand. This would require anticipation of peak periods of demand, and informing any water users (most likely those with large demands such as industrial and commercial customers) of the impending restrictions. This can also be applied to residential customers through water meters that shut off flows after usage has reached a certain level during peak demand periods.

16. Regulations of source withdrawals

Regulations imposed by government on water supply companies or other users that retrieve water directly from its source that limit the amount of water that can be withdrawn. These companies generally do not pay anything for the water that is used or withdrawn so government regulations or permits is the only way to restrict/control withdrawals.

17. Water control practices

Businesses (primarily plants) in the commercial and industrial sector can more effectively save water with better controls for monitoring water use, and more precisely matching supply with demand. Possible water saving controls that can be adopted are better mapping and metering of pipe systems and centralized displays; using automatic shutoffs to limit single function uses (e.g., taps); optimising the operation of water-using equipment with better flow and temperature controls; controlling or reducing water pressure; and automating wastewater, recirculation, and reclamation systems so that only water of less then a certain quality is treated and discharged.

18. Water recirculation/reclamation

Water saving process that can be used in industrial and commercial plants. Water recirculation is primarily used with cooling towers that use an evaporative cooling principle and bring the water in direct contact with the air. Water reclamation is the reuse or saving of water from manufacturing processes. This is primarily completed by filtering or cooling water that has been used for washing, or for cooling machines.

19. Water audits

Water audits are used to identify how and where water is being used in a facility or residence, and what the options for saving water are. Audits are generally completed in industrial, or commercial facilities with large potential for saving water, however, they may also be completed in individual

households. Steps in a residential water audit may include an interview with homeowners about water use, leak identification and repair, installation of water-efficient devices, evaluation of lawn irrigation practices and recommendation of an irrigation schedule, and distribution of publications and promotional kits.

20. Reduction of unaccounted for water (e.g., illegal and unmetered connections)

Water utilities can better control the demand for water when they know exactly how much is flowing through the system. Unaccounted for water can result from use from fire hydrants, water main leaks, inaccurate meters, or illegal and unmetered connections. While it is not possible to totally eliminate unaccounted for water it can be minimized by reducing water use and loss through any of these factors.

21. Rate structures

- Flat rate – charge for water is fixed regardless of the amount that is used (43% of Canadian households)
- Declining block rate – charge per unit of water decreases as consumption increases (12% of Canadian households)
- Constant block rate structure – charge for water increases uniformly as consumption rises (36% of Canadian households)
- Inclining block rate – charge per unit of water increases as consumption increases (9% of Canadian households)
- Seasonal rates – unit price of water increases during a peak seasonal use period
- Combination flat/block structure – Constant rate up until a certain level of water consumption, after which each successive unit of water is charged at a declining, constant or increasing block rate

The constant rate structure and increasing block rate promote water conservation since customer's bills rise at either an increasing or constant rate as consumption increases. Seasonal rate structures also promote conservation.

22. Water trading

Allocation of water to certain users by government, who are then permitted to trade amongst one another. In order for water trading to occur, there must be a clear definition of water rights, and specific allocations of water (typically by permits) to different users. The first result of water trading is that water is generally shifted to a use with the highest added value. In order to ensure that the efficiency of water trading continues, and that water is continually reallocated to the use with the highest value it is best to have temporary permits and trades. Water trading currently occurs mostly in the agricultural sector, however, it is slowly spreading to cities and industrial sectors as well.

23. Pricing policies

Pricing policies involve raising either the flat rate, or per unit volume based rates of water to encourage conservation. Currently, Canadian water prices are among the lowest in the world, and only cover about half the cost of supplying water and treating wastewater. This sends an incorrect pricing signal that encourages consumption and increases the pressure on supply systems. Pricing policies are sometimes difficult to apply since cities/utilities must determine which of the social, economic, and environmental costs of water are to be included. As well, some municipalities may purposely want to keep water rates low in order to attract industry and increase the tax base.

24. Incentives

- Financial – e.g., tax credits, rebates, loans
- Products – e.g., free home audits, water conservation kits
- Vouchers – e.g., discounts on water efficient products

Three main categories of incentives – financial, products and vouchers. Financial incentives encourage water conservation by offering low interest loans, tax credits, or rebates for the installation of water saving devices. Product incentives provide free water-conserving products to consumers such as mulches or native plants for gardens. Vouchers can offer either a financial or product incentive. Vouchers with a financial incentive generally offer discounts on water-efficient products, while those with a product incentive can be redeemed for free water efficient devices.

25. Other sanctions (fines)

Using methods such as "water policing" where wasting water by over watering lawns, or washing debris from driveways or sidewalks is an offence that requires a fine to be paid.

26. Public education

- Raise awareness of possible water problems
- Education seminars on the use of water saving devices
- Advertising campaigns to establish a "water conscience"
- Publishing of water use indexes
- Telephone hot lines

Public education can develop a stronger conservation ethic among water consumers by informing them of the water source, supply capacity or availability, and necessary treatment and distribution costs of water. Programs can update consumers about common habits that waste water, and potential ways for demand reduction.

27. In-school education

A specific form of public education program that focuses on youth. Youth will be more likely to conserve water as adults if they acquire a strong conservation ethic when they are young.

28. Information transfer and training

Involves sharing information on water conservation initiatives, and training residents and businesses in water efficient practices. Possible information transfer and training techniques include an annual compendium of new water management techniques and products, and a training program to educate staff involved in the design, management and construction of buildings about water efficient equipment and practices.

29. Regulatory (legislation, codes, standards and bylaws)

- Bylaws
- Plumbing codes
- Municipal source controls
- Conditions on new development

Regulations introduced by government to promote water efficiency. These include bylaws (e.g. restrictions on water consumption for lawn watering or car washing), plumbing codes (e.g., requirements for water efficient fixtures, usually apply to plumbing systems only), municipal source control programs (e.g., minimizing the entry of pollutants into the sewer system to reduce treatment costs and improve water quality) and conditions on new development (e.g., construction regulations encouraging ecological water use, and water conservation plans for new developments)

30. Partnerships

Implementing demand management initiatives through partnerships helps to ensure that the views/concerns of different parties that are affected by the initiatives are heard, and may contribute to the initiative receiving broader public acceptance and support.

31. Public support for research and development

Similar to what has already been done in the energy industry, the development of new products and processes for improved water management has the potential to be accelerated with appropriate funding and support for research and development. Research and development programs are usually funded by government, and are generally implemented at the provincial or federal level through departments such as the National Research Council.

32. Water logs/data collection

Water logs can be used in either homes or businesses to record daily water use, and identify areas where water saving measures may be implemented. On a larger scale, data collection of water usage by any level of government will provide a better picture of overall water use, and will help identify sectors with the greatest potential for water savings.

33. Demonstration projects

Homes, workplaces, communities, landscapes or other areas set up to demonstrate water efficient practices. They are often implemented by government (although individuals or private organizations may also set up sites), and are usually open to the public so that residents can gather water efficient ideas for their own homes, businesses, etc. A common demonstration project is the xeriscape garden, often set up by municipal governments in the summer.

34. Research on water conservation methods

Completing research on the various water conservation methods/demand management policies that are available will make cities more aware of the options they have in implementing a demand management program. Information that can be collected for various policies includes the level of staffing/ expenditure required for implementation, the long-term plans/ goals of the policy and methods that can be used for evaluation.

35. Water conservation analyst/coordinator

Water conservation analysts/coordinators are responsible for implementing and coordinating water demand management policies. Other responsibilities may include developing new water conservation initiatives, advising elected officials about water conservation programs, acting as a liaison with other key water stakeholders (e.g., community and environmental groups) and soliciting funding from provincial and federal programs.

APPENDIX 2: Inventory of Current Water Conservation Practices in Six Western Cities

CITY OF VANCOUVER

Rain Barrel Program

The City of Vancouver has designed and manufactured rain barrels that are available to residents for garden irrigation at a 50% subsidy. The rain barrel has an overflow to the storm drain, a childproof opening, a half-barrel design that allows it to sit against a wall, and two faucets to accommodate a hose and watering can. Through the rain barrel program, the City of Vancouver hopes to provide residents with a practical alternative to treated drinking water for irrigation, and to give residents the ability to take responsibility for water conservation. The cost of the rain barrel is $60 and 1,200 have been sold to date.

Roof Leader Disconnection Pilot Project

This is a pilot project established by the City of Vancouver in which homeowners can receive a subsidy towards the cost of disconnecting roof leaders that direct storm water into the sewer system. By disconnecting roof downspouts, storm water goes directly into the earth and the volume of water handled by the sewer system is reduced. This lowers wastewater treatment costs and can delay the cost of infrastructure upgrades. To participate in the project potential participants must have a City of Vancouver inspector visit their homes to determine the number of roof leaders that can be disconnected and the best method for disconnection. The City will provide the necessary instructions for disconnection, as well as any technical assistance and will follow up to ensure that the disconnection system works properly. Since not all soils are suitable for roof leader disconnections, only some homes, as determined by site inspectors, are able to participate in the program.

Retrofit Programs

A pilot retrofit program was initiated in the mid 1990s that provided low-flush toilets, low-flow shower heads and faucet aerators to 150 housing units in the City of Vancouver.

Air Conditioner Regulation

The City of Vancouver has implemented a regulation requiring that all air conditioners re-circulate the water that they use. Any air conditioner that discharges 28.4 litres per minute or less of water into a sewer without re-circulation is subject to a fine of $300 per year. A discharge of greater than 28.4 litres per minute is not allowed.

Water Rationing Bylaw

Between June 1 and September 30 of each year, the GVRD implements sprinkling restrictions. At any point during this time, even numbered addresses can only water on Wednesdays and Saturdays between 4:00 am and 9:00 am or 7:00 pm and 10:00 pm, and odd numbered addresses can only water on Thursdays and Sundays between the same times. If the water supply drops, Stage III and IV restrictions may be implemented, which further limit the use of water. Failure to comply with the restrictions set out in the water rationing bylaw can result in a fine between $75 and $2,000.

Repair of Leaks

Another City bylaw requires that customers maintain pipes, fittings, meter chambers, meter supports and fixtures in proper order without any leakage or waste. If leakage or waste does occur and notice is given by the water department, customers must repair the problem within 96 hours. If the problem is not dealt with within the specified time, the water department may shut off the customer's service pipe, have a meter installed if the location is currently not metered, or have the necessary work completed and the cost of the repair charged to the customer.

Improper Use of Water

According to this bylaw, the department of water may identify wastage or improper uses of water and give notice to customers to stop the usage within 96 hours. If the problem is not dealt with within the specified time, the water department may shut off the customer's service pipe or have a meter installed if the customer currently has a flat rate account. Any cost incurred by the City in correcting the improper use or wastage of water will be charged to the customer.

Public Awareness Program

The City of Vancouver has implemented a water conservation public awareness program that includes a media campaign; water bill inserts; the A to Z of H20 school play; public service announcements in local theatres; a calendar/workbook for elementary schools; and participation in conferences, workshops and science programs. The objectives of the public awareness program are to provide education about reasons for, and methods of, water efficiency, to advertise and support outdoor water restrictions, to encourage retrofits and advertise the program, and to encourage indoor and outdoor water conservation practices.

A to Z of H2O

A to Z of H2O, an elementary school play for students in kindergarten to grade 5, was created by the City of Vancouver as part of its public education program. The performance travels to different schools and delivers the message of economical water use to school children. The show has been performed in Vancouver for three years, and has reached an audience of 80,000. An additional 12,000 students have watched the show in Delta and Abbotsford.

Water Conservation Tips

The water conservation section of the City of Vancouver's Waterworks website provides information to residents on household water use and simple methods/tips for indoor and outdoor water conservation. The site also provides answers to frequently asked questions and general information on Vancouver's lawn watering restrictions.

Water Conservation Landscaping

The water conservation section of the City of Vancouver's Waterworks website provides information on the principles and practices of "WaterWise" gardening. Suggested methods to encourage water conservation in the garden are: to contour the land to capture rainwater, to care for the soil by adding compost or decomposed organic matter to increase its capacity to hold water, to use mulches to prevent soil from overheating or drying out, to gather rain through rain barrels, to plant naturally by layering plants to create shade and using plants native to Vancouver, to water wisely with a soaker hose, and to tend gardens patiently without manmade chemicals.

City Farmer Water Conservation Demonstration Garden

In partnership with City Farmer - Canada's Office of Urban Agriculture, the City of Vancouver has set up a water conservation garden that demonstrates the principles of "WaterWise" gardening. The garden was originally set up in 1981 to show residents of Vancouver how to grow fruit and vegetables organically on a small city lot and has evolved from there to demonstrate to residents how they can also become involved in food, water and waste conservation. Water conservation methods/devices on display include rain barrels, native plants, and a composting toilet.

Irrigation Workshops

In 1995, the City of Vancouver funded an irrigation audit of Van Dusen Gardens and Jericho Playing Fields. Using this information they developed an irrigation workshop for employees involved in irrigation. A drought tolerant planting course is also offered to the public through Van Dusen Gardens. The Greater Vancouver Regional District developed a seminar series, partnering with BC Nursery Trades Association, Irrigation Association of BC, Western Canada Turfgrass Association, and the BC Society of Landscape Architects. Full day workshops have been implemented ever year thereafter (1997-2000), providing water efficiency information and landscape and irrigation resources.

Water Efficiency Films

Each year, two public service films are developed that depict how people waste water. There are approximately 100 showings of the film in local independent theatres over a four to five week period during the summer.

Xeriscaping

A method of landscaping using drought-resistant plants, xeriscaping has been promoted as a way of conserving water resources. The City of Vancouver promotes water efficient planting and native plant landscaping through the Greenways (paths for pedestrian and cyclists in Vancouver) and other City projects. In 1995, the City created a demonstration garden to promote water conservation principles using native plants and natural organic planting methods. Using responses from a 1996 survey sent to B.C. nurseries, the City has also compiled an information resource list of plants and their availability, which are then distributed to landscape architects and nursery owners and made available to the public at garden shows and the City's demonstration garden.

Water Efficiency Initiatives for the ICI Sector

The GVRD hotel industry conducted a pilot project in 1997 to provide a better understanding of water conservation. As part of this project, three comprehensive water audits were conducted, and twenty-three water use inventories. A similar project was undertaken by the GVRD restaurant industry in 1998. In 1995, a series of workshops for the industrial, commercial, and institutional (ICI) was conducted based on these findings.

Water Audits

The GVRD conducts water audits and recommendations for all of its metered facilities in its efforts to improve water use efficiency. In this region, a total of forty sites are involved. In the City, water audits were conducted in Vancouver's three main theatres in 1996; the resulting recommendations included installation of low flow fixtures.

Composting Toilets and Water Reuse

The C.K. Choi building is a 3-storey building designed to use only 500 L of water a day, in contrast to a similar building that would consume 7,000 L of water a day, and generate 7,000 L of wastewater. This limited water demand is achieved through composting toilets, low flow fixtures, and reusing greywater and collected rainwater for landscaping.

Water Conservation Analyst

The City of Vancouver hired a water conservation analyst in 1993 to initiate a water demand management program. The position is funded through water rates from the Waterworks operating budget and responsibilities include administration of the GVRD Water Shortage Response Plan to limit summer lawn sprinkling, retrofit programs, water audits, public information and education, liaison with other City departments, development of new water conservation initiatives and solicitation of funding for initiatives from provincial and federal programs.

Fee for Establishing Water Service

This City of Vancouver bylaw requires customers who wish to establish a water service to submit an application to the water department containing all the information about the site and the type of water service required, as well as the appropriate connection and meter fees as outlined in the bylaw. If the water department determines that the cost of the water connection is greater then the base fees outlined, the customer is required to pay "at cost" for the work to be completed. If customers are applying to use an existing water service they must either pay the full connection fee or 20% of it depending upon whether or not the City has already received payment for the connection.

Ultra Low Flow Fittings

Effective July 1, 1994, the City of Vancouver mandated the installation of ultra low-flow toilets in all new homes built in Vancouver.

CITY OF CALGARY

Metering/Rates

Water utility bylaw requires that water meters be installed in all homes by December 31, 2014, and effective March 18, 2002, all new accounts must be set up on a water meter. For the City, universal metering provides better information on water consumption patterns, which allows the City to be more effective in planning facilities to meet demand and reducing leakage in the system. Through improved planning the City will also be able to better manage the water utility and run the system in a more efficient manner. Information on meter reading, meter maintenance, estimated savings and the switch from a flat rate to metered account is provided on the Waterworks website. (Note: As of December 2, 2003 Calgary residential customers were 68.86% metered. When the metering bylaw was passed in March 2002, 58% were metered. All ICI customers are currently on metered account).

For metered customers, the City of Calgary has a constant block rate structure for residential customers and a declining block rate structure for general customers. A higher constant block rate structure is in place for irrigation use. A prorated monthly service charge determined by the length of the billing period is also applied to the bill, along with a sanitary sewage charge that is calculated as a percent of the total water bill (63.23% for residential and 65.61% for general use). Water rates may increase from year to year, but any increases are generally below the rate of inflation.

Water Managed Sites

This is a certification program that identifies properties with in-ground sprinkler systems that use either climatic or historical weather data to set watering schedules as Water Managed Sites. Potential Water Managed Sites must be certified by a Certified Landscape Irrigation Auditor; water used for the sprinkler must be connected to a water meter, and the sprinkler system must meet certain tier criteria. Customers with Water Managed Sites generally experience 20% - 40% savings in water costs, and are subject to less stringent practices during watering restrictions.

Indoor/Outdoor Water Saving Kits

Water saving kits that provide water efficient fixtures/devices at reduced cost are available for purchase through the City of Calgary. Indoor water saver kits include an Earth Massage showerhead, kitchen swivel aerator, two bathroom aerators, two toilet tank bags, a package of leak detection tablets and a roll of Teflon tape for sealing and lubricating male pipe threads. Outdoor water saver kits include a garden hose nozzle, automatic sprinkler timer and rain gauge.

Toilet Replacement Rebate Program

Effective September 2003, the City of Calgary will be providing a $50 rebate on water bills to customers who replace a 20(+)-litre toilet with an approved 6-litre toilet. Rebates can only be applied for by residential metered customers. Calgary Waterworks estimates water savings of 3 million litres a day as a result of the program.

Watering Restrictions

Calgary implements watering restrictions during periods of water shortages as determined by Waterworks professionals. There are four stages of mandatory restrictions that are each implemented depending upon the severity of the water shortage. The Water Utility Bylaw provides guidelines for how and when water can be used during each of these stages. Failure to comply with the restrictions can result in fines ranging from $200 to $400 for a first time offence during Stages 1 - 4 respectively. Each subsequent offence is charged $1,000 for Stages 1 - 3 and $2,000 for Stage 4. The objective of the watering restrictions as outlined in the Water Utility Bylaw is to implement the stage that will minimize the impact of the restrictions while still achieving the goal of reducing water demand. Restrictions are designed to help the City manage Calgary's water demand during periods of water shortage.

General Water Service Interference

The Water Utility bylaw outlines a number of chargeable restrictions on water use including no person being able to use water from a fire hydrant without the permission of the General Manager of Waterworks, and no person being able to boost a service connection in order to increase water pressure. Fines generally run from $250 to $2,500, and if not paid, can result in imprisonment of up to 6 months or until the fine is paid, whichever period is shorter. A general restriction against any waste of water is accompanied with a $250 fine.

Team Water Wise

Team Water Wise is a spring and summer outdoor water conservation campaign that is designed to improve landscape watering in Calgary. Team Water Wise spends May through August traveling through Calgary communities. They provide a free inspection of in-ground irrigation systems, and recommendations to improve watering efficiency. Service is available to all residential, commercial, industrial and institutional customers. The objective of Team Water Wise is to address inefficiencies in outdoor watering. The primary goal is to reduce outdoor water demand through education and promotion of outdoor conservation techniques. Other goals include reducing strain on the water production facilities, ensuring a clean supply of drinking water is available to all citizens at all times, and reducing the effect of high water use on the environment.

Lawn and Garden Care Information

The lawn and garden section of the Waterworks website provides information on different tools that can be used to reduce outdoor water use:

- Xeriscaping: Information concerning the principles and benefits of xeriscaping and related books and websites. Lists of "water wise" plants, trees and shrubs, suitable to Calgary's climate, which require less watering, weeding, fertilizing, pruning, mowing and pesticides.
- Water Saving Tools: Information is provided on tools, such as sprinkler timers and rain gauges, which can be used to water gardens more efficiently.
- Lawn Care: Various tips are provided for watering and taking care of lawns, such as leaving the lawn at least 3 inches long so that it better maintains moisture, using an automated sprinkler system with rain sensor to control watering and aerating lawns so that air, water and fertilizer can reach the roots.
- Rain Barrels: Information is provided on what a rain barrel is, why it should be used, what can be used as a barrel, maintenance, and setup. Waterworks also supports the Clean Calgary (not for profit group) sale of rain barrels each spring.

Online Conservation Tips

A variety of conservation information is available through the Waterworks website:

- Water Use Tips: Water saving techniques/tricks for the bathroom, kitchen and utility room is provided in the Indoor Water Conservation section. In addition, this information is also available in the brochure Tap Into Indoor Water Savings.
- Water Damage Tips: Preventing water damage and reducing potential leaks.
- Water Efficient Fixtures: Information on water efficient fixtures is provide along with the estimated household water savings from changing to water-efficient showers, clothes washers, dishwashers, toilets, and faucets.
- Water Use Information: A breakdown is provided of how water is used in the home and the amount that is used by each appliance.
- Residential Water Audit: Information on conducting a residential water audit is provided in the Indoor Water Conservation section of the Waterworks website. The page explains what a water audit is, and provides a downloadable worksheet that allows residents to track water usage for a week and identify potential areas of water savings.
- Water Leaks and Basic Repairs: Information on identifying water leaks and completing basic repairs is provided in the Indoor Water Conservation section of the Waterworks website. Recommendations for detecting and locating leaks, and basic instructions for repairing taps and toilets are also provided. A leak campaign will include print, radio, and television ads.
- Water Resources: The education section of the Waterworks website provides a list of various sources for water information including a list of teacher resources (websites, projects, and activities for students), a water resource glossary, links to online games that teach children about water and a list of water books for children and adults.

Water Efficiency School Program

The City of Calgary offers a school program for grades 4-9 that explores the need to conserve water and the ways that water consumption can be reduced. Instruction kits are free and include teaching strategies to introduce the topic of water efficiency, answer keys, curriculum objectives, holistic assessment criteria, water brochures, a poster, a Waterworks beanie bear for each student, and a student activity book for each grade. Activity books for students include experiments, puzzles, and information on where Calgary's water comes from and where it goes.

Community School Program

The City of Calgary Waterworks has partnerships with community organizations that provide other forms of water education to students. These include the Evergreen Theatre that performs a musical production in schools on water use, water waste and water conservation; the Bow Habitat Station that offers a school program looking at water conservation and how a water treatment plant works; the River Watch School program that offers rafting trips down the Bow River to science classes; and the Calgary Science Network that provides in-school science presentations to students.

Radio Advertisements

Advertisements promoting water conservation and directing listeners to the Calgary Waterworks website for information on water conservation are played on Calgary radio stations.

Summer Water Conservation Campaign

Summer water conservation campaigns aim to decrease peak day water demand. Water use tends to double in the summer months due to outdoor watering. The campaigns include television ads, radio spots, newspaper advertisements, brochures, special events, and regular updates to the Waterworks website. This campaign increases the comprehension and encourages the use of efficient practices for irrigation, gardening and general outdoor water use.

Waterways Newsletter

Quarterly water and wastewater newsletter mailed out with the utility bill to all City of Calgary water customers. Includes articles/information on water quality, water conservation methods, pricing, and other aspects of the water and wastewater system.

Water Use Study

The City of Calgary has initiated a water use study that records the water use of industrial, commercial, institutional (ICI) customers. Data from the program will be used to project future water demand, and to design water efficiency and conservation programs. Results from the study will also be used to benchmark water use patterns for similar business types. Participation in the study is free of charge, and water use patterns are assessed confidentially by Calgary Waterworks with results returned to the businesses in a final report.

Combined with the Water Use Study, the Water Efficiency Program provides information on how businesses can reduce the amount of water they use without diminishing the product or quality of the service they provide. Some guidelines provided for businesses for the implementation of a Water Efficiency Program are to develop a water use inventory, use their water and sewer utility statement to track their consumption and efficiency, undertake an employee communication and participation program, and identify and implement water efficiency and conservation measures.

Water Main Replacement Program

The City of Calgary Waterworks department replaced more then 20 km of water mains in 2002.

System Leak Detection Program

An annual leak location survey is designed to locate and repair water main leaks in areas that are gravel or sand based. Without the program, leaks can

go undetected in these types of soil for long periods before any indication is noted on the surface. Each year 20 square miles are surveyed. In 2003, fifteen leaks were found and fixed, saving an estimated 39,534 m3 of water a day.

Crestmont Pilot Project

Calgary Waterworks is working in partnership with homebuilders in Crestmont (a new community in NW Calgary) on a pilot project that will introduce water conservation appliances and features into the community. The entire community, from household appliances to outdoor landscaping, is being designed for maximum water efficiency.

Water Efficient Fixtures

The City is proposing to amend a bylaw requiring six litre toilets and other low flow fixtures in new developments. The importance of the bylaw is that it will provide a clear and enforceable definition of water waste.

CITY OF EDMONTON

Metering

All water customers in Edmonton (residential, institutional, commercial, industrial, municipal) are metered.

Rate Structures

Edmonton residents pay for water under a two-part rate structure. (1) Each customer is charged a fixed monthly service charge based upon the size of his or her meter. (2) Each customer is charged a variable charge based on his or her consumption level (consumption charge).

The consumption charge is determined based on usage under three customer classes (residential, multi-residential and commercial). The residential pricing structure charges a higher rate to those who use excessively large amounts of water - referred to as an inclining block rate - to promote water conservation. The multi-residential and commercial pricing is designed with a declining block rate structure whereby a customer is charged a lower per unit rate if the customer uses more water. Large customers tend to have relatively stable consumption patterns with infrastructure requirements concentrated in certain areas of Edmonton that allows EPCOR to make more efficient use of the water system and lower operating costs.

Water rates are governed by a City of Edmonton bylaw. The current bylaw implemented a new way of setting rates called Performance Based Rates (PBR). Under PBR, EPCOR can increase rates annually for the next five years at 0.5% less than inflation. At the same time, certain performance standards must be met. If these standards are not met, EPCOR is penalized by being required to pay refunds to its customers. EPCOR met its performance standards for 2002 and implemented a 3.4% price increase effective April 1, 2003.

Edmonton Rain Barrel Project

The City of Edmonton, in partnership with the Energy Efficiency Association of Alberta, the Solar Energy Society of Canada - Northern Alberta Chapter, Environment Canada EcoAction 2000 Program, Green Communities Edmonton Association, EnerGreen Technology, Polyrama Plastics and the Sombrilla Refugee Society, sponsors the Edmonton Rain Barrel program in which residents of Edmonton can buy rain barrels at reduced cost to use for watering their gardens. The barrels come in a number of different sizes so that customers can choose the size that is most appropriate to their gardens. Other available parts include a retrofit kit with two barrel fittings, a garden hose adapter and a rain spout filter; an on/off valve to control water flow; and an adapter to hook a garden hose to the barrel overflow.

Odd-Even Watering Program

During the summer months, EPCOR encourages residents to participate in an odd-even watering program. If they need to perform outdoor watering, customers with addresses ending in an odd digit number water on odd days of the month and customers with addresses ending in an even digit number water on even days of the month.

Water Efficiency in Lawns and Gardens

Information on water efficiency in lawns and gardens is provided on the residential section of EPCOR's website. Some of the economic, environmental, aesthetic and time benefits of water efficient lawns and gardens are provided on the website, along with a description of potential costs. There is also a list of methods, tools and maintenance, and plant and garden designs that can be used in developing and maintaining a water efficient landscape.

Online Home Water Audit

EPCOR offers an online home water audit that supplies its customers with information about their annual water use and costs and provides recommendations on what customers can do to reduce them. To complete the water audit customers need to enter at least one month of water billing information, and answer a series of questions about their water use. The results are sent to customers in easy-to-follow charts and graphs that will

allow them to identify the biggest water users in their homes, along with the annual costs of each. The profiles are customized so that along with the summary information, individual tips on how to save water, and the potential dollar savings from implementing these tips are also provided. The audit responses and results are saved in individual files and can be altered so that customers can access or update them in the future. A simple home water audit that provides information on the water consumption and cost of various devices, as well as calculators for determining the amount of water lost through leaking fixtures, is also available on line.

Public Awareness

A variety of options have been used to promote water conservation to the public:

- Internet: First, EPCOR's website provides tips on water efficiency based on three points: reduce, repair, and retrofit. Information is provided on average water use and water efficient appliances, as well as how to reduce water consumption.
- Media: Extensive radio and newspaper advertising, especially during the summer peaks. Five different videos developed by EPCOR with information on water and energy conservation were run during a week long series on A-Channel's The Big Breakfast. Videos include information and easy-to-implement tips that customers can use to reduce their consumption and costs for water, electricity and natural gas. Clips of videos can be downloaded from, and viewed on, the residential section of EPCOR's website.
- Primary Education: Classroom programs and educational support materials available for grades 1-6.

Water Reuse at Gold Bar Wastewater Treatment Plant

The Gold Bar wastewater treatment plant in Edmonton uses the final effluent resulting from its liquid treatment process of wastewater for re-circulation, tank washing and other processes within the plant. In recent years, neighbouring industries have also expressed interest in using the Gold Bar effluent in place of river water for cooling and boiler processes, and golf courses and municipal parks are following investigations to determine if the effluent could be used for irrigation and recreational ponds.

Water Efficiency Coordinator

To provide knowledge in the area of water efficiency, 1.5 staff have been employed by EPCOR.

Network Maintenance Program

EPCOR has implemented a network maintenance program that has resulted in a decrease in unaccounted for water to less than 5% of total production. The main elements of the program are meter maintenance, uni-directional flushing (UDF), leak detection using an electronic leak detector, routine maintenance of main valves and curb service valves, cast iron pipe and line replacement program and a corrosion control anode inspection and replacement program. The cast iron water main replacement program in particular has reduced the number of annual main breaks from 1,600 per year in the mid 1980s to 500 per year, and has achieved a repair rate of 94% of main breaks within 24 hours.

Water Restriction Measures

EPCOR (the City-owned company that provides water services to Edmonton and surrounding municipalities) implements water restriction measures whenever the demand forecasts indicate that the water demand will exceed the combined capacities of Edmonton's reservoirs and treatment plants. There are two possible restriction measures, A and B. Measure A restrictions occur when demand forecasts predict that the volume of water available in reservoirs will be below 35% of available storage volumes within the next 10 days. During a Measure A restriction, water treatment plants modify their treatment and distribution processes and municipal and large industrial customers are asked to limit non-essential water uses. Measure B restrictions occur when demand forecasts predict that the volume of water available in reservoirs will be below 35% of available storage volumes within the next 5 days. During a Measure B restriction, voluntary outdoor watering restrictions are implemented on all non-essential use for residential, commercial, industrial and municipal water customers.

CITY OF REGINA

Rate Structure and Pricing

The City of Regina uses a constant block rate structure that currently charges $0.79/m^3 of water, and $0.67/m^3 of sewage (sewage is calculated as a percentage of water use - 82% for residential, 95% for multi-residential, and 98% for commercial). In addition, basic charges for water and for sewer are levied based on a percentage of the consumer's water consumption, and a flat fee for storm drainage is charged based on the customer's property size. All the 2003 water, sewer and drainage rates have increased since 2002, and will increase again in 2004 according to a plan for utility rates that was approved in 2001. The plan also eliminated the minimum water consumption charge that used to be included with the monthly base rate, so residents are now paying a fee for all of the water they consume. The objectives of Regina's rate structures and pricing policies are financial self-sufficiency (utilities generate revenue to cover all capital and operating costs), conservation (rates encourage citizens to use water responsibly), reduction of peak demand (rates encourage conservation during periods of peak demand, e.g. summer months), and equity (customers pay according to the services they utilize).

Communication of Water Conservation Program

A main part of Regina's water conservation program has been communication with residents. The City of Regina has undertaken a number of methods for communicating information to residents including brochures, website information, appearances on local television and radio shows, school visits, appearances at local tradeshows, xeriscape landscaping workshops, and ad campaigns using radio, newspaper and billboards. To gather resident input, the City also conducted a survey of Regina residents to determine awareness of, and participation in, water conservation initiatives.

Xeriscape Landscaping

The City of Regina has a number of initiatives that encourage xeriscape landscaping. Information on the basic principles of xeriscaping is provided on the City's Water and Sewer Water Conservation website, and a free class in xeriscaping is offered every spring and fall. The class covers the basics of xeriscape landscaping and includes a free participant workbook. A xersicape demonstration garden has also been set up at a local school in partnership with City employees, school teachers, students and parents.

Voluntary Watering Restrictions

During the summer, the City of Regina encourages residents to adopt a voluntary watering schedule program that limits watering to one day a week. Houses with odd numbered addresses are encouraged to water on either Monday, Thursday or Saturday, and houses with even numbered addresses are encouraged to water on either Tuesday, Friday or Sunday. Voluntary restrictions on watering remind residents to plan their watering and to water less frequently and more efficiently and, by so doing, help the water system meet peak demand for water during the summer months.

Tips for Water Conservation

A list of facts on water consumption and tips for saving water and money are provided on the Water Conservation section of the City's Water & Sewer website and in the 2000 State of the Environment report. Both indoor and outdoor suggestions are provided.

Plant Tours for Schools

Tours of the Buffalo Pound Water Treatment plant are provided to schools. The presentation on the tour includes a piece regarding water conservation and efficiency.

Water Conservation Program

Regina's water conservation initiatives are part of a Water Conservation Program that was first implemented in 1985, and then enhanced in 1991. The primary goals of the program are to reduce average per capita water consumption and peak day water use. Through these goals, Regina hopes to postpone capital expenditures for the expansion of water and wastewater treatment facilities. Targets for reduction of average and peak day

consumption set out in 1991 were 5% by 1996, 10% by 2001 and 15% by 2011. Since 1991, average per capita water consumption has decreased by 8.8%, and annual water consumption has decreased from 35 million m^3 in 1988 to an average of 24 million m^3 since 1993. Daily water use reduction in 2001 had decreased by 25% for average day and 43% for peak day.

Water Meter Replacement/Automated Meter Reading (AMR) Project

Regina currently has universal metering, but has recently undertaken a new program that will see the replacement of all meters installed prior to 1992, and the addition of radio transmitters to all meters installed from 1992 - 2002. The replacement of all meters older then 1992 will improve the accuracy of the meter readings since older meters may under-register water consumption. They will also be equipped with a low flow indicator that will help homeowners identify low flow water leaks (if there is water flowing through the system when all main water taps are shut off a red dial will rotate). The AMR part of the project will allow all meters to be read through a radio transmitter that transfers the meter reading to a data collector unit in a vehicle driven by the meter reader. This will eliminate the need for meter readers to enter homes, and will avoid estimated bills and "catch up" payments that would sometimes result from estimations that were too low. The program will replace approximately 50,000 meters, and install automated meter reading devices on an additional 10,000 meters. The city is now 100% metered, and city parks will be metered within the next few years.

Water Main Replacement Program

Implementation of a water main replacement program has reduced the rate of water main breakage in Regina from 0.31 breaks per kilometre in 1981 to 0.2 in 1999. From 1980 to 2002 approximately 107 kilometres of cast iron pipe (failure rate of 1.8 breaks/km) was replaced with PVC pipe where repair costs and breaks are virtually zero. The City has also concentrated on addressing small leaks before they become large breaks, and has repaired over 600 main leaks in the water mains since 1998.

Reduction of Unaccounted for Water

Unaccounted for water consists of any water that goes through the system but is not measured such as water used for fire fighting and some irrigation, and water that is lost through leaks or older water meters that do not accurately measure the water that is passing through them. The benefits of reducing unaccounted for water are that the amount of energy required for treatment of water is reduced, infrastructure costs are reduced or delayed, and the need for regulating the natural course of water is reduced or delayed. The City of Regina has set a goal of reducing unaccounted for water to less then 10%. From 1995 - 2000 they have not met this target with water loss accounting for 11.7% to 15.3% of water supplied.

Automated Irrigation Systems

The City of Regina parks and athletic fields are set up on an automated irrigation system run by a centralized computer. The automated system maximizes the efficiency of water use by matching the timing and duration of watering to weather activities. The system can also easily identify systems failures for maintenance staff.

Water Loss Reduction Coordinator

A water loss reduction coordinator deals primarily with reducing unaccounted for water in the City of Regina's water system, and is also responsible for coordinating the City's water efficiency and conservation efforts.

CITY OF SASKATOON

Metering

The City of Saskatoon tries to ensure that all users are metered.

Public Appeals

If the City perceives a problem with over-usage, it makes an appeal to citizens to conserve water.

Water Loss Audit

The City of Saskatoon is undertaking a water loss audit.

CITY OF WINNIPEG

Metering/Rates

Every water connection in Winnipeg is required to have a water meter to measure water use. The City of Winnipeg charges for water according to a declining block rate structure, and each customer's bill is composed of a fixed quarterly charge, and a water and wastewater charge based on the metered volume of water.

Winnipeg City Council approved creating a reserve fund to repair the Shoal Lake Aqueduct and a second reserve fund to provide approximately 50% of the cost to construct the water treatment plant. These reserve contributions and declining water consumption required water rate increases to meet the projected long-term funding requirement for the water utility. The total rate increases are shown below.
1990 = +7%; 1991 = +8.4%; 1992 = 8.4%; 1993 = 7.9%; 1994 = 9.8%; 1995 = 9.6%; 1996 = 10.4%; 1997 = 9.6%; 1998 = 4.0%; 1999 = 3.3%; 2000 = 2.4%; 2001/2002 = no increase.

Water Waste Prohibition

City of Winnipeg's waterworks bylaw prohibits the waste of water by running it through an outlet to prevent freezing or running it for any other purpose longer then necessary for its proper use. If a resident is found to be wasting water, their water may be turned off or other action deemed appropriate to restrain and prevent the wastage of water may be taken. In addition, anyone who willfully or maliciously discharges water so that it runs wastefully or uselessly out of Winnipeg's waterworks system may be found guilty of an offence, and if liable and convicted, may be charged a fine of $50 (along with paying for any damages incurred), or imprisoned for a term not exceeding 30 days.

Residential Retrofit Program

A pilot retrofit program was developed in 1992 that investigated and assessed methods of delivery and payment of water conservation kits. This was followed up in 1995 by a brochure promoting retrofits that was mailed to approximately half of Winnipeg's residents, and from 1996 to 1999 by water bill inserts. The Water Department currently promotes the conservation kits at their customer service counter, customer service call centre in discussion with customers, through their plumbing inspectors investigating high water bills, and online.

There are two kits available for purchase (deluxe and standard). The deluxe kit includes two adjustable spray pattern plastic showerheads, early closure flapper valves, bathroom and kitchen tap aerators and toilet dye leak detector tablets. The standard kit includes two low flow showerheads, toilet tank dams, bathroom faucet aerators and toilet dye leak detector tablets.

Slow the Flow, Save for Tomorrow Water Conservation Program

The water conservation program was developed to achieve a long-term reduction in water demand to keep consumption levels within the capacity of the aqueduct.

Winnipeg's water conservation program is a long-term program based on an understanding of how water is used, where water is used, and the influences that will cause a change in water use. The program's mission statement is: to increase water use efficiency in Winnipeg without negatively impacting the quality of life presently enjoyed by Winnipeggers and to defer expansion of the water supply system.

Since the start of the program in the early 1990s, the City of Winnipeg has used a variety of methods to create public awareness for water conservation. These included television advertisements, billboards, pamphlets in the mail, radio spots and newspaper ads. A key theme in these advertisements was a reminder to residents that saving water would also save money. In addition to the media campaigns, Winnipeg's fleet of utility vehicles were fitted with water conservation markings including the City's "Slow the Flow, Save for Tomorrow" slogan and graphics of their mascot "Wally Watersaver". The

slogan was developed through a focus group test. The appeal to conserve is presented in a positive tone to encourage current water users to think to the future generation.

The "Slow the Flow" water education program was developed by the City of Winnipeg to supplement Winnipeg's public awareness campaign and in response to statistics that showed that teenagers in Winnipeg use more water in the home then any other age group. The "Slow the Flow" program is taught to pre-teen students and is intended to develop wise water use practices before wastage begins. The program is offered in partnership with the Fort Whyte Centre, which administers the program on a day-to-day basis and provides teachers with resources and classroom support. They also send curriculum update packages, new classroom activities and experiments, and a quarterly "Slow the Flow" teacher's newsletter entitled Liquid Assets to all participating teachers. The "Slow the Flow" program is implemented through teacher pages, which include lesson introductions, background information and answer keys and student pages which include student activity sheets and resource material background information, and diagrams and graphs. The six units cover topics ranging from learning where Winnipeg's water comes from to understanding the importance of water conservation and saving water for the future. The benefits of "Slow the Flow" include water conservation awareness, youth empowerment for students who learn that they can make a significant and immediate difference in water use within their homes. The program follows provincial curriculum guidelines and has local relevance. In addition, students learn about aquatic ecosystems and the water supply system, current water uses and long-term effects of increased water consumption and water as a precious natural resource.

Estimation of Water Bills

The City of Winnipeg's website on water conservation has an online calculator that allows families to determine what their approximate water consumption should be based on the number and age of family members.

Outdoor Water Conservation

City of Winnipeg's Waterfront website on water conservation provides tips on saving water. The "five easy ways" for residents to save water in their backyards include the use of a shut-off control for hoses so that they do not run continuously, checking hose connections and valves to ensure that there are no leaks, using a barrel to catch rainwater runoff to use for watering plants, raising the height of lawn mowers so that they leave taller grass which is better able to retain water and using a broom instead of water to clean off sidewalks and driveways. Seven steps for implementing a successful xeriscape include: good planning and design, limiting turf areas, efficient irrigation, soil improvements, use of mulches, use of low water use plants and employment of proper maintenance techniques.

Recommendations for lawns include watering in the morning to reduce the amount of water lost to evaporation, ensuring a thorough sprinkling with a good soaking of the grass to encourage deep and solid root growth, fine tuning of watering practices to ensure that the entire lawn is being equally watered and that water is not hitting either the sidewalk or driveway, and stepping on the grass to determine whether or not it needs watering (if the grass springs back up after being stepped on, watering is not necessary).

New Technologies in Water Conservation

Information on new technologies is available on the City of Winnipeg's Waterfront website. This informs residents about potential water saving devices. The Water Department also conducted a study of the effect that these new technologies will have on future water use. It was concluded that significant water reduction will occur as old fixtures are replaced with modern low water use fixtures.

Manitoba Advanced House Demonstration Project

The City of Winnipeg was a partner in building the Manitoba Advanced House in Winnipeg in the 1990s. The home has a xeriscape comprised of low water use plants and shrubs, has low water use fixtures and technology and provides for metering and analysis of water use. A domestic hot water preheat system uses grey-water heat recovery. For outdoor water use, a sump pump/cistern collection system has been built.

Water Conservation Database

To assist in the ongoing evaluation of their conservation program, the City of Winnipeg developed a conservation database that includes information on quarterly water consumption for every water customer from 1992 to the present. The database compiles the quarterly water billing information and then estimates monthly consumption for analysis. For each account, the database contains information such as Census tract, sewer district, engineering district, sewer service, phone number, customer name, redirected billing information and data pertaining to water meter and water consumption patterns. The database is updated regularly to ensure that information is current and allows the Winnipeg Conservation Team to analyze usage patterns under certain parameters such as year, time of year or group of users. This information can in turn be used to target certain water conservation methods and programs.

Excess Water Use Analysis

In 1998, Winnipeg's Water Conservation Team completed an analysis of excess water usage in the summer by user group and weather patterns. This information was used to develop a predictive model which can in turn be used to warn the City of potential periods of high water usage.

Water Main Repairs

The City of Winnipeg has implemented a long-term program to reduce breaks in its 2,400 kilometres of water mains through renewal and cathodic protection. In 2002, 13.9 kilometres of water mains were renewed and 8.3 kilometres were cathodically protected. This is an ongoing asset management program and was in place long before the water conservation program. The cathodic protection program has evolved with time from doing localized repair installation to area-wide installation to better preserve the asset.

City Water Efficiency Initiatives

The City of Winnipeg has developed a number of plans to encourage water efficiency in city departments. These include pilot retrofits of city buildings, promotion of the water conservation program in a City employee newsletter, and providing city departments with the knowledge and information they require to make the City a leader and example in water conservation.

Water Conservation Team

Composed of five staff in the City's Water and Waste Department, this team's focus is to create programs that promote water conservation awareness.

Water Service Connection Permits and Fees

Residents requiring a water service connection must submit an application for service to the water department, and pay a permit fee according to the type of service that is requested. Applicants are also required to pay the cost of installation of the water service connection from the street water main to their property. This is part of a permit and inspection process governed by the Waterworks Bylaw.

#900, 1202 Centre Street South
Calgary, Alberta, Canada T2G 5A5
Telephone: 403.264.9535

www.cwf.ca